Docket (1156)D-7211

BUOYANCY DEVICES USING CONFORMAL CAVITIES

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CROSS REFERENCE TO RELATED APPLICATIONS

Not applicable

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable

REFERENCE TO A "MICROFICHE APPENDIX."

Not applicable

BACKGROUND OF THE INVENTION

-FIELD OF THE INVENTION-

This invention relates to vertical support devices that may be used to supply buoyancy support for both small and very large objects, and which would include cavities adapted to provide such support through displacement of a contained liquid.

-BACKGROUND INFORMATION-

9/10 A1

Various elements have been designed to provide a support of loads against the force of gravity which is exerted as a linearly compressive force. While heavy devices such as columns of stone and concrete have offered compressive strength and stability when made relatively wide enough to resist buckling under pressure, efforts have also been directed to providing an equal strength and stability with less weight and both large diameter tubular steel columns and beams of various cross-sectional design have found wide practical acceptance and use.

Special support elements, employing liquids to supply a hydraulic support, with the obvious exception of such things as boat hulls and pontoons, have generally relied on the use of a piston, acting in a cylinder as a means of transmitting the load pressure to the liquid for hydraulic distribution.

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Ins B

Background information pertinent to the applicant's invention includes his discovery of the exception to the conventional law of buoyancy that has been based on Archimedes' Principle, and his formulation of a revised law. In that the exception appears to ~~be~~ refute conventional logic, the following means of proof and brief explanation has been included in the specification.

Ins B1

The applicant's new Law of Buoyancy is stated variously as follows:

A body, placed in a liquid, is buoyed up by a force equal to the weight of the volume of liquid it displaces in a space not closely confined, and buoyed up by the same force within a cavity having a close horizontal spacing from the body, wherein displacement of a lesser amount of the liquid is made to immerse the body to the same extent.

Sub D1

~~it may also be said that~~

A body, placed in a cavity providing close ~~horizontal confinement~~, is buoyed up by displacement of a liquid within ~~that~~ cavity that has a force equal to the weight of a volume of the ~~liquid~~ that is the same as the volume of the body or that portion of the body which is immersed, although the volume of liquid displaced may be less.

Sub D2

~~It may also be more broadly stated that~~

~~Although varying conditions of spatial confinement can cause an immersed body to displace varying volumes of a liquid when immersed to the same extent, the upward buoyant force will remain constant.~~

Ins B2

Ins B3

DEMONSTRATION PROOF OF THE REVISED LAW OF BUOYANCY

The following demonstration can be easily duplicated and requires two pieces of fairly conventional glassware; a small test tube and a slightly larger one into which the smaller will fit with a small space left between the walls. The outside diameter of the smaller tube used in a demonstration was 15.8 millimeters and the inside diameter of the larger tube was 17.4 millimeters

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Although a conventional ~~lip~~ flaring rim on the smaller test tube will prove useful in reducing unwanted wall contact between the tubes, the ~~lip~~ rim must not be excessive. The ~~lip~~ rim must be able to pass easily and loosely inside the larger tube. B

Sub D3

CAUTION! ~~In a small~~ scale demonstration such as this there are ~~special factors that~~ must be considered. In assembling a set of closely fitting test tubes You must be aware that any usable wall spacing will suffer limits imposed by factors that might have little or no importance when making larger demonstrations, wherein a centimeter or two or even a foot or two might be a relatively close spacing. In selecting your test tube combinations for this proof, you must avoid wall spacings that are close enough to produce any hint of an appreciable piston effect, or cause the water to rise between the walls of its own accord as a result of capillary attraction, since either can add a compromising factor that will interfere with an obvious validity of proof. It is best not to seek a wall spacing appreciably less than that ~~listed~~ provided by the sample tube dimensions listed above. A

Step 1. Either accurately weigh the empty small test tube or carefully note the displacement in water inside a graduated cylinder. Help the tube to float upright in the cylinder or other comparatively unconfining container while noting the level to which the water rises on the small tube. The smaller test tube listed above displaced 20 ml. ~~as~~ an the water level was approximately one third of the length from the top. A

Step 2. Pour an amount of water from the cylinder into the larger test tube that equals approximately 75% of the smaller tube weight or of the water volume that was shown to be displaced by the small tube when floating in the relatively unconfined water. In ~~my~~ the above listed demonstration this was 11 ml, slightly more than half. A larger percentage is suggested for a first trial because the extent of horizontal confinement your tubes will provide is unknown and we want you to have positive results. A A

Step 3. Gently place the smaller test tube upright into the larger test tube. You will now be able to note how the water rises very quickly in the confined space between the walls of the two test tubes, but if you have selected tubes that provide adequate wall spacing, this will be due to the small volume of space and will not be the result of any unwanted capillary effect.

When the water reaches the level* on the smaller tube that it did when the tube was floating in the unconfined water, it should now float within the larger test tube, buoyed up by an equal force but one that is generated by a liquid displacement that we know to be substantially less than was apparently required for the same buoyancy in the relatively unconfined water.

*NOTE! A meniscus effect in the tube makes the level read slightly higher and a capillary rise will also occur on a side where the walls are closest.

If the space between the walls of your two tubes is small enough there should now be enough liquid below the floating tube to permit pushing it lower and watching it bob up again to confirm flotation. If the liquid below the smaller floating tube is considerable, repeat the demonstration with even less liquid to see how little you can use and still achieve a true flotation.

A ~~We~~ You only needed enough water to fill the space between the walls of the smaller and larger tube to the flotation level on the smaller tube before it reached the bottom of the larger tube and to thus prevent the smaller tube from reaching the bottom.

If it has required most or all of the suggested 75% of the open water displacement volume to produce enough buoyancy for flotation, you may want to find a set of test tubes

that provide closer spacing for a more pronounced effect.

With this proof, we have shown that a floating body occupying a volume of space within a liquid by virtue of its partial immersion, cannot be said to have displaced its weight of the liquid when such a weight of liquid did not exist, therefore the buoyant force exceeded the weight of the displaced liquid.

We have shown that relatively small volumes of liquid can suffice to immerse a body to an extent equal to that of larger volumes when the body and liquid are enclosed in a horizontally confining cavity.

We have shown that when varying volumes of liquid immerse a body to an equal extent, the upward thrust of buoyant force is the same, even if the weight of the immersing liquid is less than that of the immersed body.

NOTE! If the volume and weight of liquid in the tube were to be made considerably greater, or if the smaller displaced volume and weight were simply not known to be considerably less than the volume conventionally expected to be displaced by the floating tube, and if the whole of the arrangement had not also been given a prior significance, this phenomenon of this flotation would seem quite natural and unremarkable and be unlikely to attract anyone's attention. The smaller tube still appears to be displacing the same amount of liquid that it did in the graduated cylinder, since the liquid has risen to the same height at its sides and there is still a volume of space within the body of the liquid that is occupied by the same submerged portion of the test tube. In this particular instance however, we are motivated by prior knowledge to expect something special, to consider the fact that there is a scarcity of liquid; that the liquid you put into the tube

is much less than that which should be displaced in order to achieve flotation, in accordance with Archimedes' Principle. When flotation occurs under these circumstances we are made aware that the conventional Law of Buoyancy has been "broken".

A variation of this proof that effectively reinforces the validity of the revised law, and the previous proof, employs the same test tube combination.

In this instance, the tubes are assembled in a dry condition, with the smaller inside the larger and resting at the bottom of the larger. A measured quantity of water is Introduced ~~introduce~~ in increasing amounts into the space between the tube walls with a hypodermic syringe, inserting the needle tip past the rim at the ~~lip or~~ upper edge of the smaller tube to avoid letting any of the water enter the smaller tube. Watch carefully as the inserted water flows down and the level rises in the space between the tubes and especially when it approaches the level on the smaller tube at which flotation buoyancy was achieved in unconfined water. Just after this level is reached, you will observe that flotation has once again occurred. Once flotation has been confirmed, determine the weight of water required to achieve tube flotation in the horizontally confining, conformal cavity of the larger tube.

This time, the relatively small weight of liquid has moved down and under the larger weight of the smaller tube and lifted it. The conformal space condition has caused the liquid to display the applicant's discovery of a hydro-mechanical advantage that is the basis for his revision of the conventional buoyancy law.

While the base or lower portion of the cavity does not always have to conform to the base of the immersed body to produce the effect, ~~but a fully conformal cavity such as provided~~ in the test tube combination can achieve maximum buoyancy with the least liquid support and therefore the highest ratio of buoyant force to weight of required liquid.

EXPLANATION

The reason for this remarkable exception to the long standing buoyancy law dictated by Archimedes' Principle, is more easily understood if we can visualize the walls of the larger tube that horizontally confine the reduced volume of water as being equivalent to a supporting mass of surrounding water. This mass would contain this same reduced volume of water that supports the body of the smaller tube as a body-contacting portion of the larger surrounding body of water, instead of being contained as a body-contacting layer of water inside a surrounding test tube.

Of course, while the walls of the larger tube are considered to be a functional equivalent of a surrounding body of water, which would include the missing remainder of the conventionally expected liquid displacement, the walls cannot move like water into any void created by removal of the body, and the less than conventional volume remains.

It may also help if we first visualize the smaller test tube floating upright in a relatively open expanse of water, although it would not normally float upright without the larger tube or some similar side support. Then we can visualize a substantially rigid cylinder, open at both ends, with wall dimensions like those of the larger test tube, being slowly brought up from below the smaller tube, or brought down for above, to finally reach a position where it surrounds the smaller tube with the top projecting out of the water to a point slightly above the top of the smaller tube and the bottom ending just below the bottom of the smaller tube. In this position, you are not likely to sense any supportable reason to suspect that there would be anything in the arrangement that would affect buoyancy of the smaller tube.

Now if you visualize one thing further, a closing of the lower end of the cylinder,

just below the bottom of the smaller tube, in a manner like that of the larger test tube, you will begin to see that the conventional flotation can be isolated in a way that eliminates most of the water that has been believed necessary for buoyancy without affecting it.

NOTE! While the described proofs used a body and cavity having vertical walls, a horizontal confinement does not require vertical walls, merely an effective vertical component in their slope. Bodies immersed in cavities having similarly sloping walls are of special interest in that the descent of immersion reduces the spacing between walls. A4

As we may now be able to see and appreciate, a same buoyant force can be generated by the displacement of many different, relatively small, volumes and weights of liquid when in confined spaces depending upon the conditions of containment and confinement; that while a buoyant force in liquid is always equal to the weight of a volume of the liquid that equals the volume of a submerged body or portion of a body, the displacement of that volume by the body is not a universal requirement for generation of the same buoyant force.

A5

In theory, the applicant's revised law of buoyancy may provide considerable insight into the physical laws governing geophysical mechanics.

When fragments and masses of ice, and/or soil, are recently separated they may frequently occupy naturally conformal cavities by virtue of their separation, and their narrowly spaced surfaces may then become further separated by intrusive water and the resulting buoyant effect. The applicant's revised law of buoyancy, providing for the possibility of buoyancy afforded by minimal water contained within such conformal

cavities, may explain many unexpected instances of ice and soil looseness, and motility, that are not otherwise adequately explained. Where the discrete segments of a multi-fractured mass become separated by narrow water-filled crevices, the segments may have complex functions, and be both contained and containing, both confined and confining, in the effect that such buoyancy has on the whole, in accordance with the revised law.

Such flotation processes may occur within the earths's crust, at subterranean levels, in the presence of water or even oil, and also below the earth's crust, where such flotation may occur within fracture created conformal cavities with molten material as the liquid.

BRIEF SUMMARY OF THE INVENTION

The invention comprises a support device having a cavity made to horizontally conform to the sides of an immersed object in order to provide for more efficient generation of buoyant force for an immersed object or body. It also employs a full cavity conformity to the immersed shape where the use of a minimal amount of liquid is desired.

The invention can take many forms, in a widely varying range of sizes, and includes a cavity for flotation of a ship in a canal lock, a device for automatically maintaining floating device in a level state without the usual wave perturbations associated with liquid support, and a column design, for substantially vertical deployment, that employs a liquid between conformal elements to support the load of a structure. Unlike designs which transmit load force to a distributing liquid in a cylinder through a tightly sealed piston, the applicant's column support invention does not require sealing against the pressures generated by compressive force, but relies on the upward thrust provided by simple

immersion, a thrust that equals the weight of the liquid that would be displaced in accordance with Archimedes' Principle, but in accordance with the applicant's discovery, is achieved with the displacement of considerably less liquid.

While conventional logic has dictated that a body placed in a liquid is buoyed up by a force equal to the weight of the displaced liquid, the inventor has found that displacement in a cavity that has horizontally confining walls, particularly those that closely conform to the shape of an immersed object, can generate the same force with displacement of a much smaller volume of liquid and thus a smaller weight of liquid.

An object of this invention is to provide a means of supplying a normal amount of buoyant force to an immersed object with reduced amounts of buoying liquid.

Another object is to use a smaller amount of buoying liquid in order to reduce the overall size of a buoying device.

Still another object is to use a smaller amount of liquid in order to reduce the overall weight of a buoying device.

An additional object is to save time and expense in transferring liquid for the temporary float-supporting of large objects such as ships.

A further object is to provide practical usages that demonstrate a discovery which has potentially far-reaching physical implications.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention, both as to its organization and principles of operation, together with further objects and advantages thereof, may be better understood by reference to the following detailed description of the embodiments of the invention, taken in conjunction with the accompanying drawings in which:

A subD4) ~~FIG. 1 is a~~ cross-sectional and ~~cross-sectional representation of a large ship afloat in a conformal cavity that is embedded in the earth.~~ cross-sectional

A FIG. 2. is a reduced side view of the ship afloat in the conformal cavity.

A FIG. 3 is a cross-sectional side view of a float-supported instrument bearing platform, maintained in an automatically leveling state in a conformal cavity, with reduced propensity for liquid wave perturbations in its leveling motion due to having its flotational buoyancy achieved with a minimal amount of liquid.

A FIG. 4 is a cross-sectional end ~~an cross sectional,~~ view of the subject of FIG. ~~2~~ 3.

A FIG. 5 is a side cross-sectional ~~or longitudinal sectional~~ view of a support column showing the inner and outer tube spacing relationship.

A FIG. 6 is a cross-sectional end view of the same support column.

DETAILED DESCRIPTION OF THE INVENTION

A Referring first to FIG. 1, a large ship 1 is shown in an end view cross-section ~~cross section,~~ floating in water 2 within an earth supported conformal cavity 3 that is closely conforming in shape and size to the base or keel area of the ship as well as horizontally to the hull at the water-line. The drawing depicts the ship as it might appear in a cavity prepared for a demonstration/display, but except for depth, could be ~~is~~ also representative of the way it might appear in a canal lock especially prepared for ships of similar size and shape.

FIG. 2 is a side cross sectional view of the ship shown in FIG. 1.

A Referring next to FIG. 3, in a side cross-sectional view the hemispherical base of the floating platform 4, which carries instrument package 5, rests within and is closely spaced from the more fully spherical conformal cavity surface of 6, within housing 7, and is buoyed up and floated by the relatively thin layer of liquid 8. Movement of the housing and its cavity into non-level positions leave the platform in a substantially level position. The minimal amount of liquid required to achieve flotation of the hemispherical platform minimizes the possibility of perturbations in the liquid due to wave motions.

A FIG. 4 is a cross-sectional end ~~cross-sectional~~ view of the subject of FIG. 3.

Referring now to FIG. 5, a cross-sectional side ~~longitudinal-sectional~~ view of a support column shows tubular housing 9 with a cavity 10 and a base extension for attachment 11, and also with a top opening 12 and respective water inlet and air outlet openings 13 and 14 which are interchangeable in use. An inner element 15, also of tubular shaping is designed for flotation and is shown in a hollow form, although it might simply be be made of a buoyant material or with thinner walls and with a containment of lightweight supporting material.

Floating element 15 is equipped with an attachment extension 16 which protrudes from the opening 12 in housing 9. The column is designed for installation in the dry state, which permits floating element 15 to rest at the bottom of the cavity 10 in housing 9. Once placed in a vertical position, and substantially filled with water or other liquid, floating element 15 will rise to the position shown, extending the column to a prescribed length and pressing the upper end of element 15 against the opening 12 in housing 9. This extensible feature permits convenient installation in situations where the dimensions are previously fixed by other elements in a structure. When filled and fully extended the maximum force of buoyancy obtained by element 15 is exerted against the partially closed top of housing 9 and until the compressive load applied to the column exceeds that force of buoyancy, floating element 15 will remain in its upper position.

To increase the degree of column extension and make use of this feature ~~use~~ in situations where a more adjustable lift is desired, the length of the floating element 15 may be decreased relative to the length of cavity 10, and the buoyant liquid 17 added through either openings 13 or 14 in incremental amounts as desired.

This column is to be installed where lateral stability is otherwise assured, since it is designed to resist and support only a compressive force applied to connective extensions 11 and 16. Openings 13 and 14 need only to be capped and not sealed against pressure.

While the invention has been described with respect to certain specific embodiments, it will be appreciated that many modifications and changes may be made by those skilled in the art, without departing from the true spirit of the invention. It is intended therefore, by the appended claims, to cover all such modifications and changes as fall within the true spirit and scope of the invention.

What is claimed as new and what is desired to secure by Letters Patent of the United States is: